GROWTH RATE OF CALVES FED DIFFERENT TYPES OF CALF MILK REPLACER (CMR)

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Abstract

Growth rate was determined in Holstein-Friesian Cross female calves fed either High Fat CMR or Low Fat CMR. The experiment was conducted in two periods of 4 and 3 weeks respectively. In both periods, calves were fed 1 kg of either the High Fat CMR or the Low Fat CMR daily but in the first period calves were also fed 0.5 kg of concentrate daily (restricted level of concentrate feeding) and in the second period calves were fed 1 kg of concentrate daily. Although there were no significant differences between treatments in final liveweight at the end of each period and also in liveweight gain in both periods, calves fed the High Fat CMR gained slightly more weight than those fed the Low Fat CMR (679 vs 53 6 and 726 vs 536 g/day in the first and second period respectively). Final liveweights of calves fed the High Fat CMR and the Low Fat CMR in the first and second periods were 71 vs 65 and 86 vs 76 kg respectively. The major factor which influenced the differences was likely to be the higher concentration of fat and thus higher estimated ME concentration in the High Fat CMR resulting in higher total ME intake.

Key words : Growth rate , calf milk replacer

The newborn calf, after receiving colostrum from its dam during the first day of its life, should be fed considerable quantities of high quality liquid feed such as whole milk before weaning. However, where whole milk is unavailable or is highly priced, a kind of calf milk replacer (CMR) may be used. CMRs are manufactured by drying liquid butter milk, skim milk or whole milk, and are reconstituted with water to provide a liquid feed.

The newborn calf requires some fat in the diet until the rumen becomes functional. A level of 10% fat in CMRs appears to be sufficient to meet this need; to supply essential fatty acids, carry fat-soluble vitamins and supply adequate energy for normal gains (Holmes and Wilson, 1984). CMRs are usually based on butter milk or skim milk powder with additional fat and minerals. Tallow or vegetable fats are normally used to increase the fat concentration to between 15 and 18% (Holmes and Wilson, 1984). A high proportion of added unsaturated fats is undesirable as this leads to poor growth rates and interference with vitamin E metabolism.

The increased fat level not only increases the ME concentration of the diet but also improves dietary nitrogen utilisation (Holmes and Wilson, 1984). CMRs, particularly those based on skim milk powder, also require the addition of fat-soluble vitamins A, D and E. Protein concentrations of 20-24% in CMR are sufficient for liveweight gains of up to 1 kg/day. Protein concentration below 20% leads to reduced rates of gain. Most CMRs available in Thailand have protein concentrations of at least 20%.

A high concentration of fat in a milk substitute may reduce mortality (Roy, 1990). Mortality has been shown to be 8.7% to 1 month of age when the milk substitute contained 22% fat/kgDM compared to 12.8% where a milk substitute containing only 10% fat/kgDM was used (Jenny et al., 1981).

Materials and Methods

Experimental Design and Feeding Management

Eight Holstein-Friesian Cross female calves, average liveweight 45 kg and age 35 days, were blocked according to their age and weight. They were then assigned at random into 2 groups (4 calves each), one fed High Fat CMR, and another fed Low Fat CMR. The experiment was conducted in two periods of 4 and 3 weeks respectively. The calves were indi-

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vidually penned and fed CMR and concentrate twice daily at 07.00am and 04.00pm. They were allowed to adjust to the new feed for two weeks. From week 2 through weeks 5 (the first period), calves were fed concentrate at 500 g/day and 1 kg/day of CMR according to treatments (reconstituted with 8 litres of water before feeding), divided into two equal meals. Calves were not offered any roughage throughout the trial but clean fresh water was available at all times. In the second period (week 6 to week 8), calves were reared the same as in the first period except for increased concentrate feeding (1 kg/day).

Measurements

Weights of concentrate offered and left after each feeding were recorded daily. Samples of concentrate and CMRs were collected at weekly intervals and were pooled and subsampled to make one representative sample for each feed. They were then subjected to chemical analysis. Liveweights of calves were individually recorded at weekly intervals throughout the experiment. Liveweight gains were then calculated.

Statistical analysis

Liveweight gain, intakes of dry matter (DM), crude protein (CP) and estimated metabolisable energy (ME) were subjected to analysis of variance. Final liveweights were subjected to analysis of covariance using initial liveweights as covariates.

Results and Discussion

Chemical analyses of concentrate and CMRs are presented in Table 1. Fat concentration was certainly higher in High Fat CMR than in Low Fat CMR (20.8 and 14.8% respectively). However, protein percentage was slightly lower in the High Fat CMR than in the Low Fat CMR (21.53 and 23.96 respectively). Both CMRs contain sufficient protein concentration required by calves since the recommended level of protein concentration in the milk substitute should be between 20 and 24% (Holmes and Wilson, 1984). Estimation of ME concentrations were made by using conversion factors suggested by Holmes and Wilson (1984) in which each kgDM of fat, protein and carbohydrate in CMRs contains 39, 24 and 17.5 MJME respectively. Since the High Fat CMR contained more fat concentration than the Low Fat CMR, the estimated ME concentration in the High Fat CMR was therefore higher than in the Low Fat CMR.

Although final liveweight at the end of each period and liveweight gain during both periods were not statistically significantly different (Table 2), calves fed the High Fat CMR was slightly heavier than those fed the Low Fat CMR (6 and 10 kg for Periods I and II respectively). Concerning the as did final liveweight, calves fed the High Fat CMR gained slightly more weight than did calves fed the Low Fat CMR in both periods (143 and 190 g/day for Periods I and II respectively).

Table 3 showed data of DM, CP and estimated ME consumptions of calves fed either the High Fat CMR or the Low Fat CMR. The consumptions of concentrate, CMR and Total DM between the two groups in both periods were not significantly different ($p > 0.05$); however, the intakes of Total CP by calves fed the Low Fat CMR were significantly higher than were calves fed the High Fat CMR (321 vs 292 g CP/day; $p < 0.001$ and 402 vs 388 gCP/day; $p < 0.05$ in Periods I and II respectively). This is certainly due to the higher concentration of CP in the low fat CMR.

When estimations of ME concentration and the total ME intakes have been made, the calculated results showed that calves fed the High Fat CMR consumed 1.82 and 2.35 MJ more ME than those fed the Low Fat CMR. Using the ME requirements for growth in young calves fed liquid feed of 11.4 MJME/kg Gain (Holmes and Wilson, 1984), the superiorities

Table 1. Chemical analysis of concentrate and CMRs used in the trial.

Feed	%DM	%CP	%Fat	%CF	%NDF	%ADF	MJME/kgDM[1/]
Concentrate	92.7	19.85	7.85	6.86	56.6	10.7	13.0
High Fat CMR	96.9	21.53	20.82	-	-	-	22.4
Low Fat CMR	96.9	23.96	14.85	-	-	-	20.6

[1/] ME of CMRs estimated from 39 MJ/kgDM fat, 24 MJ/kgDM protein and 17.5 MJ/kgDM carbohydrate (Holmes and Wilson, 1984)

Table 2. Final liveweight and liveweight change of calves fed High and Low Fat CMRs.

	High Fat CMR	Low Fat CMR	SEM	Significant
Final liveweight (kg)	71.0	65.0	2.6	NS
Period I	86.3	76.3	5.1	NS
Period II				
Liveweight change (g)				
Period I	726	536	84	NS
Period II	726	536	116	NS

Table 3. Intakes of DM, CP and estimated ME of calves fed High and Low Fat CMRs.

	High Fat CMR	Low Fat CMR	SEM	Significant
Period I				
kgDM intake/day				
Concentrate	0.454	0.453	0.010	NS
CMR	0.969	0.966	-	-
Total	1.423	1.419	0.010	NS
gCP intake/day				
Concentrate	90	90	1.9	NS
CMR	209	231	-	-
Total	299	321	1.9	***
MJME intake/day				
Concentrate	5.90	5.89	0.13	NS
CMR	21.71	19.90	-	-
Total	27.61	25.79	0.13	***
Period II				
kgDM intake/day				
Concentrate	0.904	0.862	0.026	NS
CMR	0.969	0.966	-	-
Total	1.873	1.828	0.026	NS
gCP intake/day				
Concentrate	179	171	5.8	NS
CMR	209	231	-	-
Total	388	402	5.8	-
MJME intake/day				
Concentrate	11.75	11.21	0.37	NS
CMR	21.71	19.90	-	-
Total	33.46	31.11	0.37	***

of liveweight gain of 143 and 190 g/day in Periods I and II respectively of calves fed the High Fat CMR over those calves fed the Low Fat CMR require 1.63 and 2.17 MJME for such gains. This corresponded to the higher estimated ME intakes of calves fed the High Fat CMR in both periods (1.82 and 2.35 MJME/day). The reason best described why calves fed the High Fat CMR grew faster than those fed the Low Fat CMR is possibly that the former calves consumed more ME than the latter.

A high concentration of fat in a CMR has been showed to reduce mortality (Jenny et al., 1981), however, calves fed both CMRs grew well, had good health and gained considerable weight throughout the trial. All calves were more than 1 month old when this trial began. At this age the mortality rate was probably unaffected by the type of CMR used in the present experiment.

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References

Roy, J.H.B. (1990). **The Calf. Management of Health.** Fifth Ed Vol I. Butterworths, London, UK. 258 p.

Holmes, C.W. and Wilson, G.F. (1984). **Milk Production from Pasture.** Butterworths of New Zealand Ltd., Wellington, New Zealand. 319 p.

Jenny, B.F., Gramling, G.E. and Glaze, T.M. (1981). **Journal of Dairy Science. 64: 2284.**